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Morris ARBORETUM BULLETIN

FEBRUARY 1948

Volume 4 Number 8

FIG. 30—Alcock Spruce.
Picea bicolor (Maxim.) Mayr.

Photo by Gustave Liebscher

Published by
The ASSOCIATES of
THE MORRIS ARBORETUM

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The Morris Arboretum Bulletin is published quarterly at Philadelphia, Pa., by the Associates of the Morris Arboretum, Chestnut Hill, Philadelphia 18. Annual subscription, $1.00. Single copies 30 cents. Free to Associates.

THE ASSOCIATES, through whose interest and generosity The *Bulletin* and certain other undertakings of the Arboretum are made possible, is an informal group of individuals interested in encouraging and furthering the educational and research endeavors of the Morris Arboretum. Further information concerning this organization will be sent on request.

The Alcock Spruce

The tree of our cover photograph happens to be one of the rarer spruces, the Alcock Spruce, *Picea bicolor,* as it grows at the Morris Arboretum up the slope from the Hillcrest Avenue gate. This is the species which Ernest H. Wilson once described as "the handsomest of all the spruce trees which can be grown in this climate." His judgment is evidently based upon the performance of some particularly fine specimens which may still be seen at the Walter Hunnewell Arboretum at Wellesley, Mass. When Wilson wrote in 1916 the largest of these was then 43 feet high with a branch spread of about 40 feet. Today these trees are considerably taller and according to the most recent available information are still in excellent health. The specimen pictured at the Morris Arboretum is a vigorous although much younger tree about 18 feet in height with a branch spread of perhaps a foot less. Its shape is evidently typical: a broad pyramid formed by a central trunk thickly clothed with wide-spreading and somewhat ascending branches. Foliage color of this spruce is grayish green in general effect, the gray tone resulting from conspicuous white stomata bands on both the upper and lower leaf surfaces. Young branchlets are at first yellowish but soon turn to a lustrous reddish brown and the trunk is quite distinctive with its brownish bark peeling into aggregates of thin plates of ¼ to 1 inch diameter.

The Alcock Spruce was discovered on Mt. Fujiyama in Japan in 1860 by J. G. Veitch who named it for Sir Rutherford Alcock, then British minister at Yedo. Subsequent studies have shown it to be confined in distribution to the central range of the main island of Japan. It occurs in mixed forests but even in its native state has always been too scarce to be of any economic importance. Although introduced to Europe as early as 1861, it is still a rarity under cultivation there as well as in America. Like *Picea Maximowiczii,* one of the most beautiful of the green-foliaged spruces, also from Japan where it is now nearly extinct as a native tree, the Alcock Spruce seems to have definite ornamental value and may have economic possibilities worthy of the future attention of the geneticist.

H.T.S.

Tree Breeding at the Arboretum

During the past year many people have asked about paper bags in the Morris Arboretum. These bags have been placed on the trees to protect the female flowers from outside pollination prior to making controlled crosses. This controlled pollination work is a part of the breeding program of the Forest Genetics Project of the Northeastern Forest Experiment Station, Philadelphia, working in cooperation with the Morris Arboretum. The work is under the direction of Dr. E. J. Schreiner who is assisted by Dr. Jonathan W. Wright.

Unlike most crop plants and ornamentals, trees used for timber production have never been selected or improved in any way. We still plant seedlings from wild trees. Until a few years ago there was no need for improved timber types, but the present timber shortage has made this need evident.

The present project started in 1924 in Maine as a poplar hybridization program for a paper company. In 1937 the work was taken over by the Northeastern Forest Experiment Station, then at New Haven, Connecticut, and the scope of the work was enlarged. During the war the New Haven station was closed down and the project was moved to the Morris Arboretum which is well suited to tree breeding because of its large collections of important timber tree species.

The choice of trees on which to work is unlimited, since all need improvement. Practical considerations, however, have limited the breeding to a few of our most important genera: pine, spruce, fir, maple, oak, and ash. Improvement is being especially sought in the matters of disease and insect resistence, growth rate, tree form and wood quality. To obtain this improvement reliance is being placed mainly upon crosses between closely related species and between outstanding trees within one species. The selection of these outstanding trees from wild forests promises to be a large part of the work.

The bagging and pollinating techniques now being used were developed by Dr. Schreiner and his associates over a period of more than 20 years to meet the specialized needs of the forest tree breeder. The techniques are of interest since the bags are so noticeable to the visitor, and since the techniques differ in some details from those in use by crop plant breeders.

The bags are placed over unopened female flower buds before the flowers reach the stage where they can be pollinated by the pollen floating in the air. Since most wind-blown pollen is very fine and can sift through the smallest crack, the bags must be nearly airtight. In addition they must be weatherproof, easily applied, and must not injure the young flowers, leaves or shoots. Four different types of bags have been found useful in varying degrees: glassine, kraft paper, sausage casing and vegetable parchment.

Glassine and kraft paper bags are always used together since the former are not weatherproof and the latter are not pollen-tight. The first operation in bagging is to wrap a small piece of absorbent cotton around the selected branch at the point where the bag will be tied. This cotton keeps the bag from slipping and keeps foreign pollen from being blown or washed into the bag. A glassine bag is slipped over the flower cluster to be protected and tied tightly with twine. A kraft paper bag is tied over the glassine bag. When the bagged flowers are fully open and ready for pollination, the outer bag is slipped off and a tiny hole made in the glassine. The pollen is blown through this hole. A new glassine bag is put over the punctured one and the kraft paper bag replaced. The bags are left on the branch until all danger of uncontrolled pollination is past. These kraft paper and glassine bags have been used quite successfully for a number of genera. However, they do offer two disadvantages: application of two bags on each branch is time-consuming, and the bags absorb light and heat and apparently cause etiolation and heat injury to the enclosed branch, especially late in the season.

The sausage-casing bags are made from a cellophane-like material. The casings are cut into convenient lengths and tied securely with cotton. Only one bag is necessary for each branch as the casings are pollen-tight and waterproof. The bags are fully transparent, allowing easy examination of the developing flowers. When wet the bags are limp. In this condition they may whip in the wind and injure the enclosed flowers.

Vegetable parchment bags are made from the same material as that used for wrapping butter. The parchment is very tough when wet and withstands considerable wind and rain. It is nearly white, reflecting light and heat. Unfortunately the parchment bags are not available commercially (except in very large lots), so must be hand-made in the desired sizes with waterproof glue. When pollinating flowers enclosed in either sausage casing or parchment,

the branch end of the bag is loosened slightly, the pollen is blown in, and the bag is retied.

The glassine, sausage casings and parchment are all very brittle when dry. They do not often break while on the tree but must be humidified before application.

Two methods of pollination are in use. In the oaks, ashes, pines and other wind-pollinated species, the pollen is placed in a small glass vial fitted with a medicine dropper drawn to a fine point. The pollen is sucked into the dropper and blown from it into the bags. The droppers are inexpensive and can be thrown away after being used. Several vials and droppers can be carried around conveniently in a pocket, even when it is necessary to climb large trees, but most of the insect-pollinated maples and basswoods yield so little pollen that it is hardly possible to use the dropper technique. In working with these species it is usually necessary to brush the pollen onto the female flowers.

If the bags are not left on too long after pollination they do not seem to injure the flowers or young seeds in most species. On the contrary, they often furnish more nearly optimum conditions than prevail in the outside air. This is especially true in frosty weather when the bags provide just enough insulation to prevent frost injury. After severe frosts a few bagged branches may provide the only seed on an entire tree. Usually the bags are removed a week or two after pollination, or as soon as all danger of unwanted pollination is past. Then at intervals during the summer the flower clusters are checked for amount of fruit development. A few weeks before the seed is supposed to mature the branches are again covered—this time with cloth bags to catch any prematurely dropping seeds. A final visit to collect the seeds and bags is made to each branch after the seed ripens in September or October.

JONATHAN W. WRIGHT

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The 1947 Planting Program

Nineteen forty-seven marked the beginning of a threefold, postwar, planting program at the Arboretum: 1) the development of background plantings in areas until now used only for grazing; 2) improvement of existing evergreen plantings; 3) moving crowded plants from the nurseries, overgrown during the war.

Development of new areas. In the big, gently rolling north meadow of Bloomfield Farm were planted 77 Oak trees averaging 12-15 feet in height and representing 47 species and hybrids. These oaks begin to outline the plans envisioned for this area: the front entrance drive through tall enclosing trees; a wooded ridge from which open long vistas edged with flowering cherries, crabapples and other spring-flowering plants; a Paulownia and Lilac garden to include the useful, little-known Lilac species as well as the "100 best" hybrids. Stretching north from the Lilac garden will be a wide grass walk deeply bordered with flowering shrubs in front of tall trees. The oaks planted on the knoll in the northwest corner will shelter an overlook looking back across the meadow to the arboretum tower on the big hill. This knoll will be a center for plants decorative in fruit and of interest in winter with shaggy or colored bark, seed-pods, unusual buds or picturesque habit.

Of the 47 varieties of oaks planted this spring, 34 are new to the Arboretum. As would be expected of a genus whose distribution is predominantly in the eastern and central United States, most of the oaks planted are native to this country, though ten are native to Europe or Asia.

Improvement of existing plantings. In areas little developed by Mr. and Miss Morris, in plantings overgrown and crowded, and in plantings thinned by the loses there is need for improvement. The existing evergreen groups around the Hillcrest and Meadowbrook gates are being extended to give a feeling of richness and year-round interest at the two main entrances. For lightness, deciduous plants with brilliant fall color or with winter or early spring flowers are to be interspersed among the evergreens.

Near the Meadowbrook gate the broad lawn crowning the arboretum hill is dominated at present by the big Beeches, Sophora and European Ashes set out by Mr. Morris about sixty years ago. The effect of these deciduous trees will be enhanced, and at the same time they will

give "ceiling" to the firs and spruces being planted near them. The irregularity of a few pines will help soften the formality of the other evergreens. Because of the importance of this entrance the finest and most ornamental firs and spruces will be placed in this area. The main road curves through them before coming upon the unexpected vista across the Whitemarsh Valley. From one of the winding grass paths on the south edge of the hill will be a conifer-framed view across the Arboretum, terminated by Sugarloaf Hill.

Three pines new to the Arboretum were planted: *Pinus contorta latifolia,* the Lodge-pole Pine of the Rocky Mountains received from the Allegheny Forest Station; *Pinus echinata,* a rangy native Pine from the Forestry Station at Mt. Alto, Pa.; *Pinus peuce,* the narrow, rich Macedonian Pine, a gift from the Masonic Home in Elizabethtown, Pennsylvania.

Several varieties of dwarf Spruce have been added, all gifts from Col. Robert Montgomery's large collection in Cos Cob, Connecticut: *Picea abies* dwarf (Cos Cob #6), *P.a. Veitchii,* and two *Picea glauca nana.* The comparative smallness and grayness of the last planted near the large Purple Beech brings out the dark, graceful beauty of the Beech and repeats its rounded form.

Five large-growing spruces, also gifts from Col. Montgomery, were planted: *Picea abies compacta, P. glauca. P. Maximowiczi, P. omorika* and *P. polita.* Additions in firs include: *Abies Fraseri* dwarf, from Col. Montgomery; *A. holophylla,* a gift of the Scott Foundation; and *Abies lasiocarpa arizonica,* a choice specimen presented and planted by Mr. James Gillin.

Two procumbent yews, *Taxus baccata repandens,* and the upright *T. baccata Overeindi* which were planted, will be part of a group dominated by a weeping cherry and two firs, *Abies nobilis* and *Abies cephalonica.*

On the southeast brow of the hill is to be seen a fine specimen of Dwarf Red Cedar, *Juniperus virginiana globosa,* given by Mr. James Gillin. It is the first step toward planting the entrance-area of a future memorial to Mr. and Miss Morris.

A thirty-year old Weeping Hemlock (*Tsuga canadensis pendula)* was moved from its crowded quarters at the foot of the Germantown Avenue slope to a prominent position near the Meadowbrook Gate. Moving the five-ton ball required ingenuity and patience for the arboretum does not possess equipment for handling large trees.

To the delight of neighbors and friends of the arboretum a start has been made (above the Lodge entrance) in the removal of excess Norway Maples along Hillcrest Avenue, thereby making available for intensive planting a choice strip of ground. At the same time beautiful views both from without and within the arboretum, hitherto interfered with by the wall of Maples, are being opened up, such as the superb one across the Japanese Garden to the large blue Atlas Cedar on the slope beyond. The trees to be planted in the newly liberated area, chiefly Arborvitaes, Chamaecyparis and Juniper interplanted with winter and early-spring-flowering trees and shrubs, will form vistas complementing the slope and pointing up some of the finest trees in the arboretum. Among the plants set out are *Chamaecyparis lawsoniana* and seven of its varieties, *C. nootkatensis glauca,* four varieties of *C. pisifera,* twelve of *Juniperus chinensis,* four types of *J. virginiana,* a *Libocedrus decurrens,* six varieties of *Thuja occidentalis.* A specimen of a dense slow-growing hemlock, *Tsuga canadensis* var. *Coplen,* presented by Mr. John C. Swartley, was also planted in this area; and nearby two forms of hemlock, *Tsuga canadensis microphylla* and a thick, full, unnamed form, both gifts of Mr. Charles Jenkins. Other plants in this area were received from Mr. Gustaf Malmborg of the Masonic Home in Elizabethtown, the Allegheny Forest Experiment Station, and again our generous contributor, Col. Robert Montgomery. Given to the arboretum as small plants about twelve years ago, these evergreens have been growing into sizeable plants in the nurseries until their recent assignment to permanent locations.

At the present time beds are being prepared and dug in the northwest section of the Oak Avenue meadow for Azaleas. For the time being they will be predominantly *Rhododendron japonicum* seedlings, products of Mr. Skinner's earlier hybridization work. With their orange to yellow flowers they have been a conspicuous feature of the Oak Avenue Nursery for the past three or four years. Planting will be delayed until the Azaleas are in flower so that the best color arrangements may be made.

Thus a beginning has been made in the post-war resumption of planting. Other plans, including some which contemplate departure from traditional arboretum practices, are in various stages of development and will be reported on in future issues of the Bulletin.

MARGARET A. LANCASTER

The Organic Fungicides for the Control of Certain of Our Shade and Ornamental Tree Diseases[1]

by SPENCER H. DAVIS, JR.

During the past few years some fields of agriculture have seen a very decided change in the kinds of chemicals for combating their disease problems. The two old standbys — copper and sulfur — have the competition of many new organic fungicides in the race for popularity by virtue of providing better disease control and having less toxic effects on the hosts. The vegetable and fruit growers of the country have benefited greatly by these changes. Those interested in plants with an aesthetic value rather than a food value have received little benefit thus far. During the summer of 1947 an attempt was made to ascertain the value of some of these new organic fungicides in solving several shade and ornamental tree problems.[2]

Unfortunately, studies could not be so exacting as those conducted with vegetables and fruit. In studies with these new organic sprays on crops such as potatoes, experimental plots may be laid out so that all plants are within a relatively small area and replication and randomization of the treatments within these plots allow the data to be viewed very critically. In fruit studies the test plots are of the same age and variety and again the replication and randomization of treatments allow critical review of the data. On the other hand, an arboretum is planted with a view to beauty and is a collection of as many species as possible. It would be an uninteresting place indeed, if it were planted in rows like a potato patch, or if it had the sameness of species and varieties as found in an apple or peach orchard. Thus, when an experiment is laid out at the Arboretum, the individuals receiving treatment may be widely scattered, varying in age, limited in number, and made up of different varieties or even species. In the varying locations, a completely different ecological set-up may cause a given tree to have greater or lesser vigor and consequently be more or less susceptible to a given disease. Thus, the records of disease control on two trees a quarter-mile apart should not be compared. Certainly the varietal susceptibility of various rosaceous plants to the rusts precludes any valid discussion on the merits of various treatments when the varieties of the hosts are not definitely known.

Recognizing these many limitations to a critical review of results, these notes are presented on the control of a few diseases. However, if this work is repeated for a number of years, and if enough similar studies are made at other places, we should in time have a more complete picture of the value of the newer fungicides in controling the diseases of our shade and ornamental trees and shrubs.

In the work done at the Arboretum the dates of application for the evergreens were May 3, 16 and 27. The deciduous trees were treated on these dates plus June 10 and 28. Of the studies conducted other than at the Arboretum, the pears were sprayed on April 18, 26, and May 5 and 15, and sassafras on only the last three of these dates. These latter two studies were conducted at Cheswold, Delaware.

The compounds and rates used (pounds per gallon) were: Bordeau, 8 (copper sulphate)-8 (lime)-100; Micro sulfur, 6-100; Parzate (zinc ethylene bisdithiocarbamate), 1½-100; Zerlate (zinc dimethyl dithiocarbamate), 1½-100; Fermate (ferric dimethyl dithiocarbamate), 1½-100; Puratized N5-E (phenyl mercury triethanol ammonium lactate), 1 pint-100; and Bioquin 1 (copper-8-hydroxyquinolinolate), 1-100.

HOST: Horsechestnut (*Aesculus carnea, glabra, Hippocastanum* and *octandra.*)

DISEASE: Leaf blotch (*Guignardia aesculi*)

Compound	*Percentage Blotch*
Zerlate	2
Parzate	7
Bordeaux	11
Fermate	82
Puratized	*
Untreated	100

[1]Published as Miscellaneous Paper No. 43 with the approval of the Director of the Delaware Agricultural Experiment Station. Contribution No. 9 of the Department of Plant Pathology.

[2]The writer wishes to thank the E. I. duPont Co., for supplying the Parzate, Zerlate, and Fermate; the Gallowhur Chemical Corp., for Puratized; the Monsanto Chemical Co., for Bioquin; and the Morris Arboretum, with which these studies were cooperatively conducted.

* only moderate control early in the season and no control in late summer.

INJURY: No treatment caused injury except Bordeaux which caused roughened leaves and small necrotic spots on leaves and petioles.

RATING: Zerlate and Parzate, first; Bordeaux, second; Fermate and Puratized of no value.

HOST: Hickory (*Carya ovata*)

DISEASE: Leaf spot (*Gnomonia ovata*)

Compound	*Percentage Leaf Spot*
Zerlate	0
Parzate	1
Puratized	3
Fermate	30
Untreated	35

INJURY: None.

RATING: Zerlate and Parzate, first; Puratized, second; Fermate of no value.

HOST: Sassafras (*S. officinale*)

DISEASE: Anthracnose (*Gleosporium fructigenum*)

Compound	*Percentage Disease*
Fermate	4
Untreated	34

INJURY: None.

RATING: Fermate satisfactory.

HOST: English hawthorn (*Crataegus Oxyacantha rosea*)

DISEASE: Leaf blight (*Entomosporium theumenii*)

Compound	*Defoliation*	
	August	*October*
Bordeaux	none	very slight
Puratized	very slight	complete
Untreated	complete	—

INJURY: Bordeaux caused roughened and necrotic spotted leaves and petioles, and slight burning of the flowers; Puratized gave no injury.

RATING: Bordeaux, first; Puratized, second.

NOTE: Refer to control of Entomosporium leaf blight on pear.

HOST: Pear (Keiffer variety)

DISEASE: Leaf blight (*Entomosporium maculatum*)

Compound	*Defoliation*		*Fruit*
	September	*November*	
Parzate + lime	none	none	good
Bioquin 1	none	none	good
Untreated	90%	complete	none

INJURY: None other than slight bronzing of the leaves in late summer with Bioquin 1 treatment.

RATING: Parzate, first; Bioquin, second.

HOST: Red Oak (*Quercus borealis*)

DISEASE: Twig blight (*Sphaeropsis sp.*)

Compound	*Twig Blight*
Puratized	none
Bordeaux	none

INJURY: Bordeaux caused a roughening and crinkling of the foliage and a necrotic spotting, compared with the large, clean, smooth and glossy foliage with Puratized.

RATING: Puratized, first; Bordeaux, second.

NOTE: No untreated specimens were present for comparison of twig blight in the immediate vicinity, but trees in nearby locations were moderately blighted and this large treated tree (one treatment on each half) has been seriously blighted in previous years.

HOST: Sour gum (*Nyssa sylvatica*)

DISEASE: Twig blight (*Phomopsis ?*)

Compound	*Blight*
Bordeaux	moderate
Puratized	moderate
Fermate	severe
Zerlate	severe
Parzate	severe
Untreated	severe

INJURY: Bordeaux burned the edges of young leaves and caused slight necrotic spotting of the leaves and petioles. Puratized resulted in a heavy leaf fall in October from two of the three treated trees and remaining foliage was green rather than colorful with typical fall-coloration.

RATING: The slight control with Bordeaux and Puratized was considered offset by the injury factors. No treatment was considered adequate.

In the row of unnamed varieties of *Crataegus*, two trees were sprayed with each compound. The individual susceptibility of the hosts to the quince rust (*Gymnosporangium claviceps*) was not known. While the counts made of 500 fruits on each bearing tree are thus not indicative of the effectiveness of the compounds, the following data are given on the amounts of infection: unsprayed—45 and 22 per cent;Puratized—8 and 7 per cent; Fermate, Zerlate and sulfur—0 per cent. No fruit was present on the two trees receiving Parzate. The only injury observed in this study was a moderate chlorosis in midsummer on one of the trees receiving Zerlate.

Treating Norway maples (*Acer platanoides*) with Parzate in mid- and late-May moderately controlled anthracnose (*Gleosporium apocryptum*) in mid-summer, but by early fall these trees were about as badly infected and defoliated as the untreated. (These observations were made at Georgetown, Delaware.)

Two varieties of red cedar (*Juniperus virginiana glauca*, and *J. v. Schottii*) which are particularly susceptible to the quince rust (*G. claviceps*) were treated with Puratized before and during the formation or rust spores (*telia*). neither inhibition of spore production nor injury to the trees occurred.

Austrian pine (*Pinus nigra austriaca*), flowering dogwood (*Cornus florida*), and black wal-

nut (*Juglans nigra*) were also treated with the various compounds used on other hosts. The presence of disease was so variable that no conclusions can be drawn. Some specimens of pine were free from disease while others treated with the same compound were heavily infected with the tip blight (*Sphaeoropsis ellisii*). *Myxosporium* twig blight was very erratic in its appearance with the various treatments on dogwood. No compound caused injury on any of these hosts although the normal fall coloration of the dogwoods appeared to be delayed by Puratized.

Obviously, these studies and the ratings given the compounds are very preliminary. The results are from one season's work only and the number of plants in each group was small. However, it seems safe to assume that future studies here and elsewhere will result in the adoption of more of the new organic fungicides for combating diseases of our shade and ornamental trees and shrubs.

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John Story Jenks and William M. Elkins

The Advisory Board of Managers of the Morris Foundation recently has lost through death two valued members, John Story Jenks and William M. Elkins. In their very active business carrers they found time to lend their talents to diverse cultural enterprises and movements in Philadelphia. Both students in their own right, they brought a sympathetic understanding to the problems of the educational institutions which they served so freely.

Mr. Jenks, a connoisseur of art, particularly Chinese, was a member of the Board of Managers and one time President of the University Museum; of the Philadelphia Museum of Art; of the Thomas W. Evans Museum and Institute Society; and of the Fairmount Art Association. His attainments in the field of art were recognized by the French Government in awarding him the decoration Chevalier d'Honneur. Mr. Elkins, a noted collector and student of books and paintings, was Vice-President of the Philadelphia Museum and School of Industrial Art and a trustee of the Free Library of Philadelphia.

The wisdom and counsel they contributed so generously in the Board of Managers of the Morris Foundation are gratefully acknowledged by the Arboretum.